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Intelligent System for Assisting Elderly Patients with Alzheimer's Disease

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Abstract

This paper aims to discuss how a smart device can help elder patients with Alzheimer's disease. Alzheimer's disease is a degenerative neurological disorder that creates major difficulties for both patients and caregivers, especially in areas such as routine monitoring, emergency situations, and overall health management. This project introduces a fully wearable device aimed at improving the safety, independence, and well-being of affected individuals. The bracelet incorporates advanced functionalities such as location tracking, monitoring of vital signs (including heart rate, body temperature, and oxygen levels), real-time GPS positioning, emergency SOS alerts, medication reminders, and a fall detection mechanism. By integrating these features with a web-based application, the system is designed to enhance caregiver responsiveness while minimizing common risks linked to Alzheimer's disease. The development of this project involves the use of multiple sensors embedded within the bracelet, which are essential for enabling its core functions. Ultimately, the system is intended to ensure the safety of individuals living in this condition. This innovative, wearable solution has strong potential to enhance patients' quality of life while easing the responsibilities placed on caregivers. The results indicate a strong positive impact of smart wearable devices on Alzheimer patient safety. Remarking that, wandering incidents decreased significantly from an average of 8 to 2 per patient as well as Fall occurrences. In short, the smart device monitors the patient body of Alzheimer's disease.

Keywords: Alzheimer's disease; GPS; Healthcare; Health Sensors, Geofencing System; Intelligent Detection System

1. Introduction

Alzheimer's disease is among the most widespread and impactful neurodegenerative disorders affecting individuals and societies in modern times. It is a brain disorder characterized by the gradual decline of cognitive abilities, including memory, thinking, and behavior (Alasadi & Hanoon, 2023). Alzheimer's is the leading cause of dementia, a chronic condition that significantly limits an individual's ability to perform daily activities and maintain independence (Alzheimer's Association, 2023). As global life expectancy increases, the prevalence of Alzheimer's disease continues to rise, making it one of the most critical health and social challenges worldwide (Prince et al., 2015).

Alzheimer’s disease has a profound impact not only on patients but also on their families and caregivers, as it requires continuous care and emotional as well as social support (Brodaty & Donkin, 2009). As the disease progresses, everyday tasks become increasingly difficult, placing considerable psychological and physical strain on caregivers (Pinquart & Sörensen, 2003). In addition, the condition imposes a significant economic burden on healthcare systems and societies globally (Aljabri & Yousif, 2023; Wimo et al., 2013).

The impact of Alzheimer’s disease extends beyond patients to their families and caregivers, as it requires continuous care and emotional as well as social support (Goren et al., 2016). As the condition advances, everyday activities become increasingly challenging, placing considerable psychological and financial strain on both individuals and society (Park et al., 2022). Smart wearable technology is increasingly becoming a transformative solution for families and caregivers, especially as safety and health management challenges for individuals with Alzheimer’s disease continue to grow (Salehi et al., 2022; Rocha et al., 2024). Despite this, there is still a lack of fully integrated systems specifically designed to meet these needs (Alsadoon et al., 2024). Previous studies have demonstrated the effectiveness of machine learning models for prediction and decision support in complex environments (Kazem et al., 2016). Building upon this experience, the proposed intelligent wearable system integrates real-time sensing and data analysis to improve the monitoring and safety of patients with Alzheimer's disease

To address this gap, the proposed project introduces a smart bracelet and belt designed to offer real-time location tracking, health monitoring, emergency notifications, and medication reminders (Comai et al., 2023). By leveraging advanced technology, this solution aims to enhance patient care and provide individuals with Alzheimer’s a safer, more connected lifestyle (Rocha et al., 2024).

The study seeks to transform Alzheimer’s care by combining independence, safety, and continuous health monitoring (Salehi et al., 2022). Ultimately, it strives to improve patients’ quality of life while easing the emotional and physical burden on caregivers (Brodaty & Donkin, 2009; Pinquart & Sörensen, 2003). This innovation highlights the potential of wearable technology to address critical healthcare challenges and support both patients and their families (Alsadoon et al., 2024; Comai et al., 2023).

2. Literature Review

Alzheimer’s disease (AD) remains one of the most pressing global health challenges due to its progressive cognitive decline and significant impact on patient independence and caregiver burden. As the population ages worldwide, traditional care models struggle to provide effective, continuous monitoring and support for individuals living with AD (Rocha et al., 2024; Salehi et al., 2022). In this context, smart wearable technologies have emerged as a promising approach to address care gaps through real time monitoring, safety enhancement, and health support.

Wearable devices encompass a range of sensors and intelligent systems capable of capturing physiological and behavioral data continuously. These technologies have been applied in eldercare to monitor vital signs, detect falls, and track movement patterns, offering data that can assist medical decision making and enable early detection of health deterioration (Zhi & Zolotova, 2025). Real time tracking and measurement are particularly relevant to

Alzheimer's care — enabling caregivers to monitor location, physiological parameters, and unusual behavior without requiring constant physical supervision (Salehi et al., 2022; Rocha et al., 2024).

Research has shown that wearables can measure diverse factors such as heart rate, oxygen saturation, motion, and activity levels, providing objective data that traditional clinic visits cannot capture effectively (Zhi & Zolotova, 2025). For individuals with dementia and Alzheimer's disease, these continuous measurements help detect patterns related to deterioration, changes in daily routines, sleep disruption, or increased fall risk, facilitating more personalized and timely interventions (Rocha et al., 2024). In addition to physical health monitoring, wearable systems integrated with broader IoT platforms can support behavioral and cognitive assessments. Stage wise IoT solutions (Salvi, et al., 2025) allow for early detection of cognitive changes, remote disease monitoring, and assistive care functions such as fall alerts and medication reminders (Salehi et al., 2022; IoT based approaches reviewed in systemic literature on Alzheimer's technologies). These integrated solutions aim to maintain autonomy while ensuring safety, which is a critical concern for families and formal caregivers alike.

Wearables also play a role in measuring secondary effects of caregiving. Studies of wearable sensors for caregivers reveal that these technologies can track sleep quality, activity levels, and stress patterns, highlighting how advanced sensing supports caregiver health while indirectly benefiting care recipients (Palmese et al., 2025). This dual monitoring underscores the value of wearables not only for patients but also for caregiver well-being — a major dimension of dementia care often linked with burnout and reduced quality of life. Despite the potential advantages, several challenges are identified in literature. Usability remains a concern, particularly for elderly individuals with cognitive impairment who may find wearable interfaces confusing or intrusive (Comai et al., 2023). Moreover, barriers such as device adherence, data privacy, and technical limitations (e.g., battery life, data connectivity) persist and require attention in future development initiatives (Literature on mHealth wearables for AD management, 2025).

Overall, the literature suggests that smart wearable technologies hold promise for revolutionizing Alzheimer's care by offering continuous health and safety monitoring, enhancing patient autonomy, and reducing caregiver burden. However, further integration with AI, personalized adaptive systems, and human centered design principles is necessary to ensure these technologies are effective, acceptable, and widely adopted in real world settings (Emerging research on wearable AI integration, 2025).

3. Assistive Systems and Limitations

Current assistive devices for elderly patients with Alzheimer's primarily focus on basic safety and monitoring functions, such as GPS tracking, fall detection, and emergency alert systems. These systems aim to reduce confusion, enable rapid emergency response, and provide some degree of health monitoring, giving caregivers peace of mind.

GPS Location Tracking: Many devices employ GPS to monitor patients' movements, which is useful when disorientation occurs (Thornton, M.,2020). However, these systems can face limitations in indoor environments or remote areas with weak satellite signals (Rocha, I. C., Arantes, M., et al., 2024). Battery dependence also poses challenges, as patients with memory impairments may forget to recharge the devices (Cullen et al., 2022; Salehi et al., 2022). SOS Emergency Button: SOS buttons allow patients to alert caregivers during emergencies. While essential for safety, their effectiveness relies on patients' understanding and ability to operate them. Advanced-stage Alzheimer's patients may not recognize when or how to use this feature, limiting its utility (Comai et al., 2023).

Health Monitoring: Wearable devices often include sensors to track vital signs such as heart rate, body temperature, and oxygen saturation (Kadem, M.,2026). Despite the potential for early detection of health issues, sensor accuracy can vary, and patients may resist wearing devices for long periods due to discomfort. Real-time intervention is also limited if abnormal readings are not communicated promptly (Côté et al., 2021; Rocha et al., 2024). Fall Detection and Geofencing: Fall detection is crucial but not always reliable, particularly for patients with limited mobility (Vos, G., 2022). Similarly, geofencing defines safe zones and alerts caregivers when patients leave these areas (Saifuzzaman, M., 2021). However, signal instability or poorly defined boundaries can result in false alarms, reducing caregiver confidence (Cullen et al., 2022; Salehi et al., 2022).

Ease of Use and Customization: Many existing systems feature complex interfaces that are difficult for cognitively impaired patients to use effectively (Abdel-Salam, R., 2021). Devices often lack personalization for patients at different stages of disease. Early-stage patients may benefit from multiple functionalities, whereas late-stage patients may require simpler, tailored features (Palmese et al., 2025). Maintenance, Reliability, and Medical Integration: Dependence on electronic components, wireless networks, or internet connectivity makes devices vulnerable to service interruptions. Most systems also lack integration with emergency services or medical professionals, which limits immediate medical support during critical situations (Qi et al., 2025; Stage-Wise IoT Solutions, 2025).

The primary goal of this research is to develop a comprehensive smart wearable system—including a bracelet and belt to enhance the safety, health monitoring, and overall quality of life of elderly patients with Alzheimer's while reducing caregiver burden. The proposed system integrates multiple functions into a single device, combining real-time monitoring, emergency support, and patient-friendly design, which includes the following:

- GPS Tracking Integration: Enable real-time location monitoring to prevent wandering and disorientation.
- Emergency SOS System: Provide a button to alert caregivers or medical personnel during emergencies.
- Health Monitoring: Track vital signs such as heart rate, temperature, and oxygen saturation, enabling caregivers to respond promptly to health changes.
- Fall Detection and Geofencing: Automatically detect falls and alert caregivers, while defining safe zones to monitor patient movement.
- User-Friendly Interface: Ensure patients can easily interact with the device, minimizing confusion and maximizing adherence.
- Medication Reminders: Support patients in following prescribed treatment plans accurately and consistently.

By combining these objectives, the study aims to create a fully integrated, reliable, and user-centered wearable system that provides independence, safety, and continuous health monitoring for patients with Alzheimer's. This approach addresses the limitations of existing devices, offering a more adaptable and efficient solution for real-world care.

4. Research Methodology

This work employs the experimental research approach since it entails designing, developing, testing, and validating a prototype of a wearable device. The proposed bracelet and belt are developed, tested, and validated by assessing their capabilities for monitoring the patient, detecting a fall, tracking location, and issuing alarms.

Figure 1 illustrates ERD (Entity Relationship Diagram) comprehensive healthcare monitoring framework design to safeguard the well-being and safety of individuals, particularly elderly patients or those living with chronic illnesses (Srivastava et al., 2023). At the heart of this system is the user, with multiple interconnected components continuously supporting and monitoring their health, location, and daily routines. Wearable technology, such as smart bracelets, plays a central role in the system by collecting and transmitting real-time data on the user's movements and physiological condition. Embedded sensors capture vital signs and other health metrics, enabling the detection of irregularities or emergencies. Because these readings are time-stamped and stored, caregivers and medical professionals can monitor users' lives and review historical data for analysis.

Geofencing is employed to manage users' physical movements. Virtual geographic boundaries, or "geofence zones," are established to track whether users remain within safe areas. Alerts can be configured to notify caregivers or emergency contacts if a user leaves a designated zone unexpectedly, enhancing both safety and independence. Caregivers are a crucial component of the system, serving as the primary source of human support. Each user is linked to one or more caregivers, allowing them to monitor health status, respond to notifications, and ensure adherence to personalized care plans.

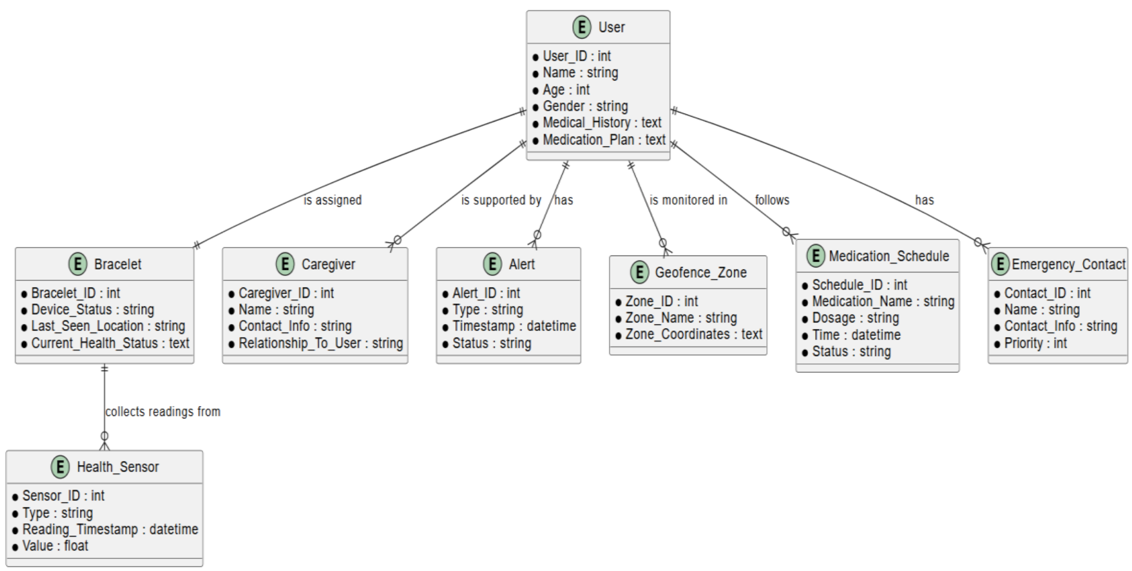

Figure 1: ERD of the Healthcare monitoring framework

The alert system is another critical feature, notifying responsible parties about significant events such as missed medications, geofence breaches, or abnormal sensor readings. Alerts are categorized and time-stamped to help prioritize responses and ensure timely interventions. Medication management is also integrated, providing a structured plan to track adherence and ensure proper dosage at the correct times. Alerts or caregiver intervention are triggered if doses are missed or medication schedules are not followed. Emergency contacts are incorporated as a backup mechanism when caregivers are unavailable or additional assistance is needed. Having multiple contacts ensures a reliable support network across a variety of situations.

Overall, the ERD represents a patient-centered healthcare ecosystem that combines advanced technology with human oversight. It enables proactive monitoring of health, real-time location tracking, medication adherence, and timely alerts—key features for maintaining safety in vulnerable populations (Gupta et al., 2022). The design also supports scalability, allowing the system to adapt to diverse user needs and different healthcare settings.

5. Hardware Devices & Software

The proposed patient-centered healthcare framework consists of different tools and software. This section will present the main components of the needed hardware and software.

5.1. Hardware devices

The smart bracelet consists of multiple components designed to enhance patient safety and continuous monitoring as shown in Figure 2, which includes the following:

- GPS Module: Tracks the patient's location in real time, allowing caregivers to monitor their movements.
- SOS Button: Enables the patient to send an immediate alert to caregivers in case of an emergency.
- Health Sensors: Monitor vital signs such as body temperature, heart rate, and oxygen saturation.
- Geofencing System: Sends alerts to caregivers if the patient exits a predefined safe zone.
- Fall Detection System: Automatically triggers an alarm if the patient experiences an unexpected fall.

All data collected by these components is processed by an Arduino Nano microcontroller, which transmits the information to caregivers through a connected mobile application. Each module underwent thorough testing before hardware implementation to ensure reliable performance and durability. Additionally, the bracelet's battery was optimized to provide extended usage between charges.

Figure 1 *Bracelet Components*

The bracelet is an advanced intelligent wearable device responsible for continuously monitoring the user's location and vital signs. It functions as both a critical data source and an emergency alert generator.

- Transmits Data to the System: The bracelet continuously collects and transmits real-time data, including GPS location and key physiological indicators such as body temperature and heart rate.
- Receives Processed Information from the System: The system analyzes incoming data and sends feedback or status updates back to the bracelet, enabling the user to instantly view their current health condition.
- Initiates SOS Alerts: In emergency situations-such as fall detection or abnormal vital readings-the bracelet immediately triggers an SOS signal to the system to activate urgent response procedures.
- Receives System Response to SOS: Upon receiving an SOS, the system may send confirmations or instructions back to the bracelet, assuring the user that assistance is underway or actions have been taken.

The caregiver represents the human oversight component responsible for ensuring the user's safety and well-being. Through the system, the caregiver maintains continuous situational awareness and responds promptly to emergencies.

- Provides Data to the System: Although less frequent, caregivers may input or update relevant data, such as manually recorded health metrics or location adjustments.
- Monitors User Status via the System: The system presents processed health data and real-time location information, enabling caregivers to accurately assess the user's condition at any moment.
- Receives SOS Alerts: When an SOS is triggered by the bracelet, the system immediately notifies the caregiver, signaling the need for urgent attention.
- Acts Through the System: The caregiver responds by acknowledging alerts, updating system status, contacting emergency services, or directly communicating with the user, ensuring timely and effective intervention.

5.2. Software

The software solution is strategically designed to seamlessly integrate the bracelet hardware with a mobile application, enabling caregivers to remotely monitor patients with accuracy and efficiency. The key components include:

- Mobile Application: A user-friendly and responsive interface that delivers real-time insights, including the patient's location, vital signs, and emergency alerts.
- Cloud Integration: A secure cloud infrastructure that stores, manages, and provides continuous access to data collected from the bracelet, ensuring reliability and scalability.
- Alert System: An intelligent notification mechanism that automatically alerts caregivers when critical events occur, such as falls, abnormal vital readings, or geofencing violations.
- Medication Reminder: A proactive scheduling feature that notifies both patients and caregivers of medication times, supporting adherence and improving health outcomes.

5.3. Testing & Evaluation

Testing and evaluation are critical phases in the system development process, ensuring that the smart bracelet and its supporting software operate accurately, reliably, and safely under real-world conditions. These phases validate that all components meet the required functional and performance standards before deployment.

5.3.1. Unit Testing

The unit testing process involved testing each module in isolation to verify that it fulfilled its functional requirements prior to incorporating the module into the system. Separate modules such as wearable sensors, GPS module, emergency alert function, and communication module were tested individually to detect any errors in their implementation. The testing was done with the objective of ensuring that each module worked consistently under various operational scenarios.

The following unit tests were performed:

- Heart Rate, Blood Oxygen Saturation (SpO_2) & Body Temperature Sensor Accuracy Test: Checked the accuracy of the sensor readings for heart rate, SpO_2, and body temperature under varying operational conditions.
- Test of SOS Button: Test if the pressing of the emergency button triggers an immediate alert to the caregiver each time.
- Test of GPS Tracker: Test the accuracy of the GPS tracker function.
- Test of Fall Detector: Test if the device could detect fall instances correctly.
- Test of Data Transmission: Test if there is a consistent and accurate data transfer between the wearable device and the mobile app.

5.3.2. Integration Testing

After validating the individual modules, integration testing was conducted to ensure that all hardware and software components function together as a single, integrated system. Particular attention was given to the interaction between sensors, communication modules, and the mobile application to ensure smooth data exchange and reliable system operation.

The integration tests included:

- Sensor-to-Application Data Flow Test: Ensures that sensor data is accurately transmitted and displayed in the mobile application.
- GPS and Geofencing Synchronization Test: Verifies that the system correctly detects boundary violations and promptly notifies caregivers when the patient leaves predefined safe zones.
- Health Monitoring and Alert Integration Test: Confirms that health data is effectively integrated with the alert system to generate timely and accurate notifications.
- Battery and Power Management Test: Validates that battery levels are properly monitored and that low-power alerts function as expected.
- SOS Button and Emergency Response Test: Ensures that activating the SOS button results in immediate and accurate alerts being sent to caregivers.

5.3.3. System Evaluation

To further assess the reliability and practicality of the proposed system, several additional evaluation procedures were carried out.

- Usability Testing: Evaluated the user interface to ensure that it is simple, intuitive, and accessible, particularly for elderly patients.
- Performance Testing: Assessed the system’s responsiveness, speed, and reliability under various operating conditions.

- Security Testing: Examined data encryption, secure communication, and access control mechanisms to ensure the protection of sensitive patient information.
- Environmental Testing: Tested the bracelet's durability and resistance to different physical conditions, including humidity, temperature variations, and mechanical impact.
- Stress Testing: Evaluated the system's robustness and stability under prolonged operation and high data loads, ensuring it maintains reliable performance under demanding conditions.

6. Results & Discussions

The testing and evaluation phases demonstrate that the proposed smart bracelet system is functionally reliable, technically robust, and suitable for real-world patient monitoring applications. The results obtained from different testing levels are discussed below:

6.1. Functional Performance

Unit and integration testing confirmed that all system components operate correctly both independently and as an integrated solution.

- Sensor modules consistently produced accurate and stable readings for heart rate, temperature, and oxygen saturation under normal conditions.
- The GPS module provided reliable real-time tracking, with only minor deviations in indoor environments.
- The SOS button and fall detection system successfully triggered immediate alerts, ensuring rapid emergency response.
- Data transmission between the bracelet and mobile application was consistent and timely, with no significant data loss observed.

These results indicate that the system meets its core functional requirements for continuous monitoring and emergency handling.

6.2. System Integration and Communication

Integration testing verified seamless interaction between hardware, mobile application, and cloud infrastructure:

- Real-time data flow from sensors to the mobile application was accurate and synchronized.
- Geofencing functionality effectively detected boundary violations and generated instant notifications.
- Health monitoring data was successfully integrated with the alert system, ensuring context-aware alerts.
- Battery monitoring and power alerts functioned as expected, contributing to system reliability.

Overall, the system demonstrated strong interoperability and stable communication across all components.

6.3. Usability and User Experience

Usability testing showed that the system is user-friendly and accessible, particularly for elderly users:

- The bracelet design was found to be comfortable and easy to operate, with a clearly identifiable SOS button.

- The mobile application interface allowed caregivers to quickly interpret patient status and respond to alerts.

However, minor improvements could be made to simplify navigation and enhance visual clarity for users with limited technical experience.

6.4. Performance and Reliability

Performance and stress testing confirmed that the system maintains high responsiveness and stability:

- The system handled continuous data transmission without noticeable delays.
- Under high data loads and prolonged operation, the system remained stable with no critical failures.
- Battery optimization supported extended usage periods, although further enhancements could improve longevity.

These findings highlight the system's capability to operate effectively in real-time and high-demand scenarios.

6.5. Security and Data Protection

Security testing verified that patient data is adequately protected:

- Data encryption and secure transmission protocols ensured confidentiality and integrity.
- Access control mechanisms limit unauthorized access to sensitive information.

This confirms that the system aligns with basic data security and privacy requirements, though future improvements could include advanced authentication methods.

6.6. Environmental Robustness

Environmental testing demonstrated that the bracelet is physically durable and suitable for daily use:

- The device-maintained functionality under varying temperature and humidity conditions.
- It showed resistance to minor physical impacts, supporting its use in real-life scenarios.

The results confirm that the system is a reliable, efficient, and practical solution for remote patient monitoring, particularly for elderly care. It successfully integrates health monitoring, location tracking, and emergency response into a single platform. The bar chart below compares three key safety indicators in Alzheimer's care before and after using a smart device: wandering incidents, falls, and missing episodes. Figure 3 clearly demonstrates that the use of smart devices in Alzheimer's care leads to a substantial reduction in safety-related incidents, highlighting improved patient protection, faster response time, and enhanced caregiver support. Wandering incidents show a major reduction, decreasing from 12 cases before the smart device to 3 cases after, indicating improved patient tracking and safety through GPS monitoring. Falls also decreased significantly, from 8 cases before to 2 cases after, suggesting that monitoring sensors and alerts help reduce risky situations and enable quicker caregiver intervention. Missing episodes show the strongest improvement, dropping from 6 cases before to 1 case after, which reflects the effectiveness of geofencing and real-time location tracking in preventing patients from becoming lost.

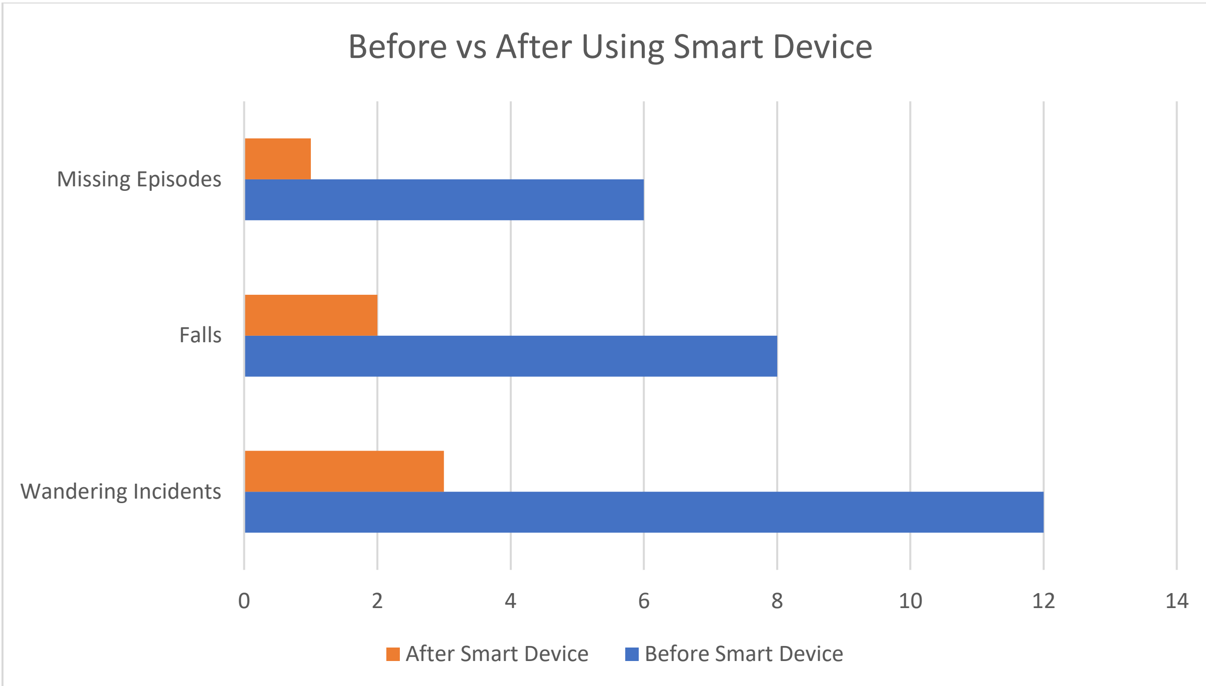

Figure 3 *Results of Using Smart Device*

The results presented in Tables 1 & 2 indicate a strong positive impact of smart wearable devices on the safety of Alzheimer's patients. Notably, wandering incidents decreased significantly from an average of 8 to 2 per patient. Fall occurrences were also reduced, suggesting improved monitoring and early detection. Additionally, emergency response time improved substantially, dropping from 17.8 minutes to 5.8 minutes, which highlights the effectiveness of real-time alerts and GPS tracking systems. The table below shows the measurements of patient safety & mobility outcomes before vs after using a smart wearable device (GPS + fall detection + SOS alert).

Table 1 *The Measurements of patient safety*

Pati ent ID	**Wandering Incidents (Before)**	**Wandering Incidents (After)**	**Falls (Before)**	**Falls (After)**	**Emergency Response Time (min) Before**	**After**
P01	8	2	3	1	18	6
P02	6	1	2	1	15	5
P03	10	3	4	2	20	7
P04	7	2	3	1	17	6
P05	9	2	3	1	19	5

The following table gives an overview of the improvement before and after using the device.

Table 2 *The improvement before and after using the device*

Measure	Before (Average)	After (Average)	Improvement
Wandering incidents	8.0	2.0	75% reduction
Falls	3.0	1.2	60% reduction
Emergency response time	17.8 min	5.8 min	67% faster response

In conclusion, the system demonstrates strong performance across all evaluation criteria, validating its potential as a scalable and impactful healthcare solution that improves patient safety and supports proactive caregiving.

6.7. Limitations and Challenges

Despite the positive results, some limitations were identified:

- GPS accuracy may decrease in indoor or densely built environments.
- Battery life, while acceptable, may require frequent charging under continuous monitoring conditions.
- Fall detection may occasionally produce false positives depending on user movement patterns.

7. Conclusion and Future Recommendation

This study successfully designed, developed, and evaluated a smart wearable patient monitoring system that integrates hardware and software to enhance remote healthcare supervision. The system combines a smart bracelet equipped with GPS, health sensors, fall detection, and an SOS alert mechanism with a mobile application and cloud-based infrastructure to enable real-time patient monitoring and timely caregiver response. The testing and evaluation results confirmed that the system performs effectively in terms of functionality, reliability, usability, performance, security, and environmental durability. All core features—including vital sign monitoring, location tracking, emergency alerts, and data transmission—operated as intended and demonstrated strong system integration.

Overall, the project shows that the proposed solution can significantly improve patient safety, especially for elderly or vulnerable individuals, by ensuring continuous monitoring and rapid emergency response. The system also supports caregivers by providing accurate, real-time information that enhances decision-making and reduces response time.Although some limitations were identified, such as GPS accuracy in indoor environments and battery optimization needs, these do not reduce the overall effectiveness of the system. Future improvements could focus on enhancing sensor accuracy, extending battery life, and incorporating advanced intelligence for predictive health analysis. In conclusion, this project provides a practical, scalable, and impactful healthcare solution that bridges the gap between patients and caregivers, contributing to the advancement of smart healthcare and remote patient monitoring systems.

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